

09/17/03

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Karlheinz MAYR, Walter KILL, Thilo SCHMIDT,
Gunter PHILIPP and Hubert REMMLINGER
Serial no. :
For : PROPORTIONAL PRESSURE-REGULATOR
VALVE
Docket : ZAHFRI P536US

MAIL STOP PATENT APPLICATION
The Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Dear Sir:

By way of preliminary amendment, please amend the above identified application as set forth below.

In the Specification:

Please amend paragraphs 002, 003, 004, 009, 010, 029, 030 and 033 of the specification as follows in which the specification additions are shown by underlining and the specification deletions are shown by strikeout. Please enter the replacement specification paragraphs into the record of this case.

In the Claims:

Please cancel claims 1-22, without prejudice or disclaimer of the subject matter therein, in favor of new claims 23-44 as follows.

[002] FIELD OF THE INVENTION

[003] ~~According to the preamble of claim 1, t~~The instant invention relates to a proportional pressure-regulator valve. The invention further covers, according to the preamble of claim 17, a method for regulating a pressure level of a pressure medium with a proportional pressure-regulator valve.

[004] BACKGROUND OF THE INVENTION

[009] The problem on which the invention is based is solved by a proportional pressure-regulator valve ~~having the features of claim 1 and a method of regulating a pressure level in a hydraulic circuit with a proportional pressure-regulating valve having the features of claim 17.~~

[010] SUMMARY OF THE INVENTION

[029] BRIEF DESCRIPTION OF THE DRAWINGS

[030] ~~For better understanding the invention is now explained~~ The invention will now be described, by way of example, with reference to an embodiment and to a p-l characteristic line shown in the enclosed drawings where the accompanying drawings in which:

[033] DETAILED DESCRIPTION OF THE INVENTION

1-22. (CANCELED)

23. (NEW) A proportional pressure-regulator valve for regulating a pressure level in a hydraulic circuit, comprising:

a housing containing an armature rod (5) extending between a proportional magnet (1) in the housing and a control element situated in the hydraulic circuit;

the proportional magnet (1) having a magnetic coil (4), a magnetic core and a magnetic armature (3) connected to the armature rod (5), and said magnetic coil (4) and at least a part of said magnetic core are firmly connected with said housing (11);

a magnetic force existing within a first gap (12) between said magnetic armature (3) and said magnetic core for axially moving said magnetic armature (3) and said connected magnetic armature (3) back and forth between a first and a second end positions within an interior space of said magnetic coil (4);

said magnetic core partly projects into the interior space of said magnetic coil (4) and is concurrently concentrically situated about said armature rod (5) and the motion of said magnetic armature (3) relative to said first magnetic core results in an actuation of said control element, and

wherein said proportional magnet (1) also has an adjustable second gap (10) for regulating the magnetic force axially moving said magnetic armature (3) and said connected magnetic armature (3).

24. (NEW) The proportional pressure-regulator valve according to claim 23, wherein said magnetic core comprises at least one first part (2) and one second part (6) provided coaxially about said armature rod (5).

25. (NEW) The proportional pressure-regulator valve according to claim 24, wherein said second part of said magnetic core (6) is positioned axially movable between said first part of said magnetic core (6) and said housing (11) to define the adjustable second gap (10) for said first part of said magnetic core (2).

26. (NEW) The proportional pressure-regulator valve according to claim 24, wherein said first part of said magnetic core (6) is disposed concentrically around said armature rod (5) and the relative axial motion of said second part of said magnetic core (6) results from a pressure force.

27. (NEW) The proportional pressure-regulator valve according to claim 26, wherein to produce the pressure force, a shift valve (13), which can be removably

contacted with said second part of said magnetic core (6) to axially supply the pressure force to said second part of said magnetic core (6).

28. (NEW) The proportional pressure-regulator valve according to claim 27, wherein said shift valve (13) is made of non-magnetic material and is concentrically disposed around and axially movably relative to said armature rod (5).

29. (NEW) The proportional pressure-regulator valve according to claim 26, wherein the pressure force can be produced hydraulically, pneumatically, or mechanically.

30. (NEW) The proportional pressure-regulator valve according to claim 29, wherein said shift valve (13) is actuated in proportion respectively to a load requirement and a hydraulic pressure in the hydraulic circuit.

31. (NEW) The proportional pressure-regulator valve according to claim 27, wherein said shift valve (13) is designed as a hollow cylindrical sleeve which is located in a passage of said housing (11) and seals the passage oil-tight.

32. (NEW) The proportional pressure-regulator valve according to claim 27, wherein said shift valve (13) has on a front side a substantially annular pressure surface which is connected with a feed line (16) of the hydraulic circuit and can be loaded with a hydraulic pressure force.

33. (NEW) The proportional pressure-regulator valve according to claim 24, wherein said first part (2) and said second part (6) of said magnetic core have corresponding contact surfaces (7, 8) which produce in the second gap (10) a radial magnetic field line crossing between said second part (6) and said first part (2) of said magnetic core.

34. (NEW) The proportional pressure-regulator valve according to claim 33, wherein said contact surface (7) of said first part (2) of said magnetic core is situated upon an outer cone.

35. (NEW) The proportional pressure-regulator valve according to claim 33, wherein said contact surface (8) of said second part (6) of said magnetic core is designed upon an inner cone.

36. (NEW) The proportional pressure-regulator valve according to claim 27, further comprising a breather hole (15) in said housing (11) which ventilates the space formed by said shift valve (13), said second part of said magnetic core (6) and said housing (11).

37. (NEW) The proportional pressure-regulator valve according to claim 24, wherein between said second part (6) and said first part (2) of said magnetic core (6), concentrically with said armature rod (5), a pressure spring (9) is disposed which produces a spring tension between said second part (6) and said first part (2) of said magnetic core and said shift valve (13) and wherein said spring tension counteracts the hydraulic pressure force.

38. (NEW) The proportional pressure-regulator valve according to claim 24, wherein a non-magnetic disc (17) is provided which firmly connects the first part (2) of said magnetic core with said housing (11).

39. (NEW) A method for regulating a pressure level in a hydraulic circuit with one proportional pressure-regulator valve comprising the steps of:

- providing an armature rod (5) extending between a control element located in the hydraulic circuit with a proportional magnet comprising a magnetic core, a magnetic armature (3) and a magnetic coil (4);

- axially moving said magnetic armature (3) back and forth between a first and a second end positions according to a magnetic force existing in an air gap (18)

- controlling the magnetic force according to a magnetic flow in a magnetic circuit which is adjustable by an amount of electric current applied to said magnetic coil (4);

- providing a magnetic core comprising at least one first part (2) and one second part (6); and

- creating in the magnetic circuit a second gap (10) to generate a magnetic resistance for regulating the magnetic force.

40. (NEW) The method according to claim 39, further comprising the step of adjusting said second gap (10) by moving a second part of said magnetic core (6) positioned coaxially about said armature rod (5).

41. (NEW) The method according to claim 40, further comprising the step of hydraulically, pneumatically or mechanically actuating a shift valve (13) to move said second part of said magnetic core (6).

42. (NEW) The method according to claim 41, further comprising the step of actuating said shift valve (13) by a hydraulic pressure proportional to a load requirement in the hydraulic circuit and adjusting the magnetic force according to the electric current flowing into said magnetic coil (4) and the load requirement in the hydraulic circuit.

43. (NEW) The method according to claim 39, further comprising the step of adjusting the magnetic force between said first part of said magnetic core (2) and the magnetic armature (3) as the width of said second gap (10) diminishes and the magnetic resistance in the magnetic circuit becomes weaker.

44. (NEW) The method according to claim 39, further comprising the steps of positioning a pressure spring between said second part (6) and said first part (2) of said magnetic core, which, as the hydraulic force diminishes on said second part of said magnetic core (6), the second part moves away from said first part of said magnetic core (2) enlarging said second gap (10) between said second part (6) and said first part (2) of the magnetic core and diminishing the magnetic force.